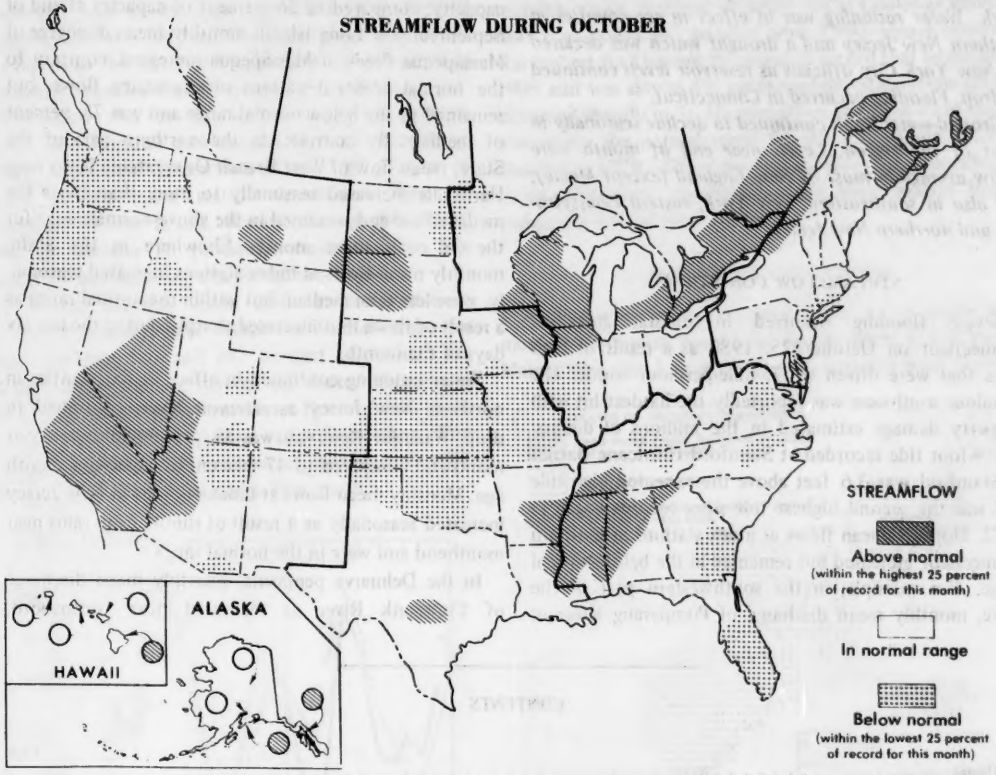
WATER RESOURCES REVIEW for OCTOBER 1980

UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

CANADA
DEPARTMENT OF THE ENVIRONMENT
WATER RESOURCES BRANCH

STREAMFLOW DURING OCTOBER



STREAMFLOW AND GROUND-WATER CONDITIONS

Streamflow generally increased in southeastern Canada, Arkansas, Nebraska, Nevada, Oklahoma, Oregon, and most States in the Northeast and Southeast Regions. Monthly mean flows generally decreased in Florida, Hawaii, Iowa, Missouri, New Mexico, Oregon, Wisconsin, southwestern Canada, and all States adjacent to the Ohio River. Elsewhere, flows were variable.

Below-normal streamflow persisted in parts of Arizona, Connecticut, Florida, Georgia, Kansas, Kentucky, Minnesota, Nebraska, New Mexico, New York, North Carolina, North Dakota, Oklahoma, Oregon, Utah, and Virginia. Monthly and/or daily mean flows were lowest of record for October in parts of Connecticut, Florida, and Georgia. Water use restrictions remained in effect in parts of New Jersey, New York, and Oklahoma, where contents of principal reservoirs remained much below average.

Monthly mean discharges remained in the above-normal range in parts of several States in and adjacent to southern Nevada and Wisconsin, in parts of southeastern Canada, Alaska, Hawaii, New York, Montana, Ohio, Tennessee, and Texas, and increased into that range in parts of Alberta, North and South Dakota, and several States in and adjacent to Mississippi. Monthly mean flows were highest of record for October in parts of Quebec. Flooding occurred in Connecticut and Mississippi.

Ground-water levels continued to decline seasonally in the Northeast Region. Except for Maine, levels were below average in most of New England, southeastern New York, eastern Pennsylvania, and northern New Jersey. In the Southeast Region, levels generally declined in West Virginia and Kentucky, with slight rises in Mississippi; trends were mixed elsewhere in the region. Levels were above and below average. Trends were mixed in the Western Great Lakes Region, and were above and below average. In the Midcontinent Region, mixed trends prevailed except for general declines in North Dakota and Iowa. Levels were generally below average except locally in Iowa and Texas. In the West, levels rose in Washington and declined in Montana and Arizona; trends were mixed elsewhere in the region. Levels were below average in Washington, Idaho, Arizona, and New Mexico, and mixed with respect to average in other States.

New high ground-water levels for October were recorded in southern California, Nevada, and Utah. New October lows occurred in Arizona, Arkansas, Idaho, Louisiana, New Mexico, and Utah, and three new alltime lows were reported in Arizona.

NORTHEAST

[Atlantic Provinces and Quebec; Delaware, Maryland, New York, New Jersey, Pennsylvania, and the New England States]

Streamflow decreased in parts of Pennsylvania, but generally increased seasonally in all other parts of the region. Monthly mean flows remained above the normal range in parts of the Atlantic Provinces, Quebec, and New York, increased into that range in parts of the Delmarva peninsula, and were highest of record for October in parts of Quebec. Mean discharges remained in the below-normal range in parts of Connecticut and New York. Water rationing was in effect in six counties in northern New Jersey and a drought watch was declared by New York City officials as reservoir levels continued to drop. Flooding occurred in Connecticut.

Ground-water levels continued to decline seasonally in most of the region. Levels near end of month were below average in most of New England (except Maine), and also in southeastern New York, eastern Pennsylvania, and northern New Jersey.

STREAMFLOW CONDITIONS

Severe flooding occurred in coastal areas of Connecticut on October 25, 1980 as a result of high tides that were driven by 75-mile-per-hour winds. The populous southwest was reportedly the hardest hit with property damage estimated in the millions of dollars. The 9-foot tide recorded at Stamford Hurricane Barrier at Stamford was 3.6 feet above the expected high tide and was the second highest tide since records began in 1972. Monthly mean flows at index stations in southern Connecticut increased but remained in the below-normal range. For example, in the southwestern part of the State, monthly mean discharge of Pomperaug River at Southbury (drainage area, 75.0 square miles) increased seasonally, remained in the below-normal range for the 2d consecutive month, and the daily mean flow of 5.6 cfs on October 1, 1980, was lowest for October in 48 years of record. Elsewhere in the State, mean flows increased seasonally and were within the normal range.

In southeastern New York, streamflows were generally in the 90 to 98 percent flow-duration range prior to the storm of October 25. A drought watch was declared by New York City officials on October 16 as reservoir contents continued to decrease. At monthend, the New York City reservoir system was at 45 percent of capacity, compared to 56 percent of capacity at end of September. On Long Island, monthly mean discharge of Massapequa Creek at Massapequa increased, contrary to the normal seasonal pattern of decreasing flows, but remained in the below-normal range and was 75 percent of median. By contrast, in the northern part of the State, mean flow of West Branch Oswegatchie River near Harrisville increased seasonally to more than twice the median flow and remained in the above-normal range for the 3d consecutive month. Elsewhere in the State, monthly mean flows at index stations increased seasonally, were less than median, but within the normal range as a result of flows that increased sharply during the last six days of the month.

Water rationing continued in effect in six counties in northern New Jersey as reservoir levels continued to drop. Wanaque Reservoir was 38 percent of capacity at monthend compared to 47 percent of capacity a month ago. Monthly mean flows at index stations in New Jersey increased seasonally as a result of runoff from rains near monthend and were in the normal range.

In the Delmarva peninsula, monthly mean discharge of Choptank River as measured near Greensboro,

---

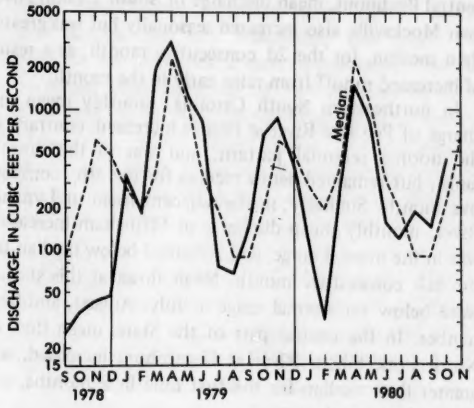
CONTENTS

Maryland, increased seasonally to 278 percent of median and was above the normal range for the first time since May 1980. In central Maryland, mean flow of Seneca Creek at Dawsonville increased, contrary to the normal seasonal pattern, but remained in the normal range for the 4th consecutive month and was 131 percent of median.

In western Pennsylvania, monthly mean flows at index stations decreased, contrary to the normal seasonal pattern of increasing flows, but were within the normal range as a result of decreased runoff from below-normal precipitation during the month. In the east-central part of the State, monthly mean flow of Susquehanna River at Harrisburg increased slightly to 57 percent of the October median flow and remained in the normal range for the 4th consecutive month.

Streamflow was in the normal range throughout central New England and ranged from 75 percent of median in central Massachusetts to 145 percent of median at the index station on Branch River at Forestdale, Rhode Island. Runoff during the general storm of October 25 produced moderate rises, but streamflow was declining sharply by monthend.

In Maine, monthly mean flows at index stations increased seasonally, were within the normal range, and ranged between 182 and 243 percent of median. For example, in the central part of the State, where mean flow of Piscataquis River near Dover-Foxcroft was above the normal range in August and September, flow increased sharply to 219 percent of median in October but was within the normal range. (See graph.)



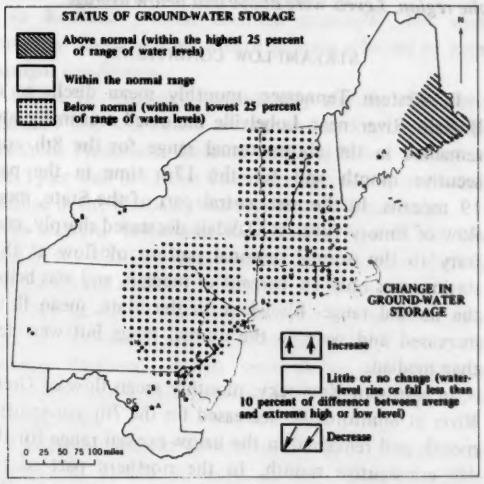
Monthly mean discharge of Piscataquis River near Dover-Foxcroft, Maine (Drainage area, 297 sq mi; 769 sq km)

Streamflow increased seasonally throughout the Atlantic Provinces and monthly mean flows were generally double the previous month at all index stations. Mean flows were above the normal range in New Brunswick and on Cape Breton Island, Nova Scotia, and within the normal range elsewhere.

South of St. Lawrence River in eastern Quebec, monthly mean flow of Matane River near Matane increased seasonally to 273 percent of median and remained in the above-normal range for the 4th consecutive month. In southern Quebec, flow of St. Francois River at Hemmings Falls increased to 163 percent of median and remained in the above-normal range for the 2d consecutive month. North of the St. Lawrence River in southwestern Quebec, the monthly mean discharge of 6,090 cfs at Coulonge River near Fort-Coulonge (drainage area, 1,990 square miles) was highest for October in period of record that began in 1908 and was almost 4½ times median. Streamflow also increased sharply in St. Maurice River at Grand Mere and was above the normal range for the first month since December 1979. Elsewhere in the Province, monthly mean flows were generally greater than median but within the normal range.

GROUND-WATER CONDITIONS

Ground-water levels continued to decline seasonally in most of the region, except for rises in levels in much of Maine. (See map.) Levels near end of month were below



Map shows ground-water storage near end of October and change in ground-water storage from end of September to end of October.

average in most of New England other than Maine, and were also below average in southeastern New York, eastern Pennsylvania, and northern New Jersey. Levels were above average in east-central parts of Maine.

SOUTHEAST

[Alabama, Florida, Georgia, Kentucky, Mississippi, North Carolina, South Carolina, Tennessee, Virginia, and West Virginia]

Streamflow decreased in Florida, Kentucky, and West Virginia, and in parts of Alabama, and Tennessee, but increased elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Tennessee, and increased into that range in parts of Alabama, Georgia, and Mississippi. Mean flows remained in the below-normal range in parts of Florida, Georgia, Kentucky, North Carolina, and Virginia, and decreased into that range in parts of Tennessee. This was the 8th consecutive month of above-normal mean flow in part of Tennessee, and the 4th consecutive month of below-normal mean flows in parts of Florida, Georgia, Kentucky, and North Carolina. Monthly and daily mean discharges were lowest of record for the month in part of Florida. Flooding occurred in Mississippi.

Ground-water levels generally declined in West Virginia and Kentucky, and mostly rose slightly or held steady in Mississippi. Trends were mixed elsewhere in the region. Levels were above and below average.

STREAMFLOW CONDITIONS

In western Tennessee, monthly mean discharge of Buffalo River near Lobelville increased seasonally and remained in the above-normal range for the 8th consecutive month and for the 17th time in the past 19 months. In the east-central part of the State, mean flow of Emory River at Oakdale decreased sharply, contrary to the normal seasonal pattern of flow at that station, was only 16 percent of median, and was below the normal range. Elsewhere in the State, mean flows increased and were in the normal range but were less than median.

In southern Kentucky, monthly mean flow of Green River at Munfordville decreased for the 7th consecutive month and remained in the below-normal range for the 4th consecutive month. In the northern part of the State, mean discharge of Licking River at Catawba also decreased and was less than median, but was in the normal range for the 4th consecutive month.

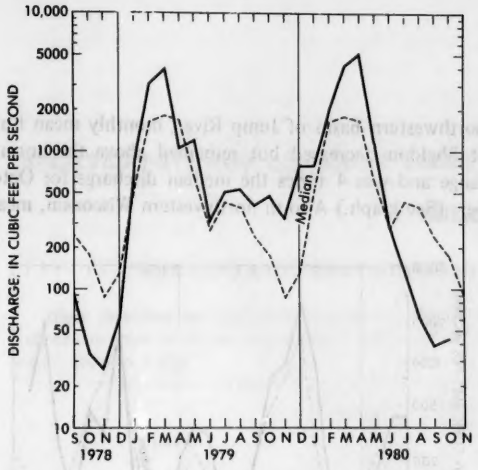
In West Virginia, monthly mean flows decreased in all parts of the State, contrary to the normal seasonal pattern, were less than median, and were within the normal range.

By contrast, monthly mean flows increased seasonally in all parts of Virginia, and were below the normal range in the northern and central parts of the State. For example, in northern Virginia, mean flow of Rapidan River near Culpeper increased seasonally but was only 44 percent of median and was in the below-normal range for the first time since November 1978. In the central part of the State, mean flow of Slate River near Arvonia also increased seasonally, was only 56 percent of median, and remained below the normal range for the 2d consecutive month. Elsewhere in Virginia, mean flows were less than the median flows for the month and were in the normal range.

In the eastern Piedmont of North Carolina, where mean flow of Deep River at Moncure in September was only 18 percent of median, mean discharge increased, contrary to the normal seasonal pattern, and remained below the normal range for the 4th consecutive month. Also in the eastern Piedmont, mean flow of Cape Fear River at William O. Huske Lock near Tarheel increased seasonally and was in the normal range, following 2 consecutive months of flow in the below-normal range at that station. In the Coastal Plain, monthly mean discharge of Contentnea Creek at Hookerton increased, contrary to the normal seasonal pattern, but remained below the normal range for the 4th consecutive month. Mean flows at this index station in August and September were only 20 percent of median in each month. In the mountains of western North Carolina, mean flow of French Broad River at Asheville increased seasonally and was in the normal range, but remained below median for the 4th consecutive month. In the central Piedmont, mean discharge of South Yadkin River near Mocksville also increased seasonally but was greater than median, for the 2d consecutive month, as a result of increased runoff from rains early in the month.

In northeastern South Carolina, monthly mean discharge of Pee Dee River at Peedee increased, contrary to the normal seasonal pattern, and was in the normal range, but remained below median for the 5th consecutive month. Similarly, in the adjacent basin of Lynches River, monthly mean discharge at Effingham increased, was in the normal range, and remained below median for the 5th consecutive month. Mean flows at this station were below the normal range in July, August, and September. In the central part of the State, mean flow of North Fork Edisto River at Orangeburg increased, was greater than median for the first time in 5 months, and was in the normal range.

In extreme northern Georgia, monthly mean flow of Etowah River at Canton increased, contrary to the normal seasonal pattern, and was above the normal range. By contrast, in the southern part of the State, mean discharge of Alapaha River at Statenville remained in the below-normal range for the 4th consecutive month. (See graph on page 5.) Similarly, in the eastern part of the State, monthly mean flow of Altamaha River at



Monthly mean discharge of Alapaha River at Statenville, Ga. (Drainage area, 1,400 sq mi; 3,630 sq km)

Doctortown remained below the normal range for the 3d consecutive month. In the Apalachicola River basin of western Georgia, mean discharge of Flint River near Culloden increased, contrary to the normal seasonal pattern and was in the normal range, following 3 consecutive months of flow in the below-normal range. Downstream, near the Georgia-Florida boundary, monthly mean flow of Apalachicola River at Chattahoochee, Fla., decreased seasonally, remained below median for the 4th consecutive month, and remained in the normal range for the 5th consecutive month.

In Florida, the usual sharp increase in October monthly mean flows resulting from runoff during tropical storms did not materialize this year. For example, in the west-central part of peninsular Florida, the monthly mean discharge of 153 cfs, and the daily mean of 103 cfs on the 16th, in Peace River at Arcadia (drainage area, 1,367 square miles) were lowest for October in 47 years of record. In the nearby basin of Fisheating Creek at Palmdale, mean flow decreased sharply to 8 percent of median and was in the below-normal range for the 4th time in the past 5 months. Similarly, in the eastern part of peninsular Florida, monthly mean discharge of St. Johns River near Christmas decreased to 5 percent of median, remained in the below-normal range for the 4th consecutive month, and was lowest for October in 48 years of record. Elsewhere in the State, monthly mean flows decreased seasonally and were less than median but were within the normal range.

In central Alabama, mean discharge of Cahaba River at Centreville increased sharply, as a result of runoff from intense rains near monthend, was 2½ times median, and was above the normal range. Mean flows during August and September were in the below-normal range at this station. In the west-central part of the State, mean flow of Tombigbee River at Demopolis lock and dam, near Coatopa, also increased sharply as a result of runoff from rains near monthend, was 3½ times median, and was above the normal range for the 10th time in the past 14 months. Elsewhere in the State, mean flows were less than median and were within the normal range.

In central Mississippi, monthly mean flow of Big Black River near Bovina increased sharply as a result of runoff from intense rains near monthend, was 5 times the median discharge for October, and was in the above-normal range. The National Weather Service reported flash flooding in the Big Black River basin October 28. In the southeastern part of the State, mean flow of Pascagoula River at Merrill also increased sharply into the above-normal range and was 185 percent of median.

GROUND–WATER CONDITIONS

In West Virginia, ground-water levels declined in most parts of the State. Levels were above average in the northwestern third of the State and in the southern quarter, and below average elsewhere.

In Kentucky, levels declined seasonally, but were generally above average except in areas affected by local drought conditions.

Levels in Virginia changed only slightly. The level declined but was above average in the key well in the northern Piedmont, declined and was below average in the Tyler well in Louisa County, and rose but was below average in the Matoaka Manor well near Petersburg.

In western Tennessee, the artesian level in the key well in the 500-foot sand near Memphis declined slightly and continued nearly 15 feet above average.

Levels in North Carolina declined in the mountains, eastern Piedmont, and Coastal Plain and rose in the western Piedmont. Levels were above average in the mountains and in the Piedmont and below average in the Coastal Plain.

Levels rose slightly or held steady in most aquifers in Mississippi. Levels in wells in the Mississippi River alluvial aquifer rose slightly. Levels in the Miocene and Graham Ferry formations in southern Mississippi and along the Gulf Coast remained stable. Levels in wells in the central part of the State and around the Jackson metropolitan area in the Sparta Sand and Cockfield Formation rose slightly after establishing several record low levels during August and September 1980. In

northern Mississippi, water levels in the Wilcox and Upper Cretaceous aquifers generally held steady except in areas influenced by heavy pumping, where levels declined slightly.

Levels in wells in Alabama rose in the central part of the State and were above average. In the southeast, levels declined and were below average.

Levels in wells in Georgia declined slightly in the Piedmont. In the coastal counties, levels in the principal artesian aquifer showed mixed trends. Levels in the water-table aquifer declined to 4 feet below average and were at or slightly higher than the minimum for the period of record. In the southwest, levels in key wells declined as much as a foot.

Levels declined in most areas in northern and central Florida. However, the level in the key well at Pensacola in the western panhandle rose slightly, and the level rose 2.4 feet in the well at Ocala in the north-central peninsula. Levels ranged from about a foot above average at Pensacola to 14 feet below average near Mulberry in west-central Polk County. In southeastern Florida, levels ranged from about the same to 1½ feet above those of the end of September; the greatest rises occurred in northern Dade and Broward Counties. Month-end levels were as much as 1½ feet below average.

WESTERN GREAT LAKES REGION

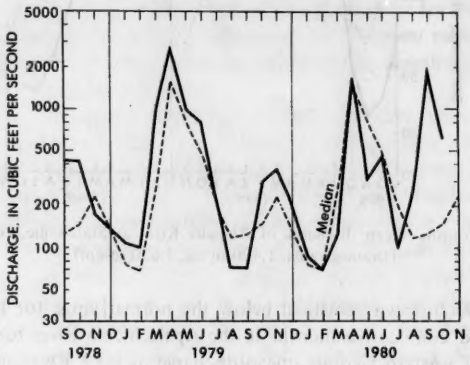
[Ontario; Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin]

Streamflow increased in Ontario and in parts of Michigan and Minnesota, but decreased elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Ontario, Illinois, Michigan, Ohio, and Wisconsin. Mean flows remained in the below-normal range in parts of Minnesota, and decreased into that range in parts of Illinois. This was the 3d consecutive month of mean discharge in the above-normal range in parts of Illinois, Michigan, and Wisconsin, the 4th month in parts of Ontario, and the 5th month in parts of Ohio.

Ground-water levels showed mixed trends. Levels were above and below average in the northern part of the region and near or above average in the southeastern part.

STREAMFLOW CONDITIONS

In Wisconsin, streamflow remained in the above-normal range, except in the northeastern part of the State, as a result of high carryover flow from September and runoff from rains during the month. In the northwestern basin of Jump River, monthly mean flow at Sheldon decreased but remained above the normal range and was 4 times the median discharge for October. (See graph.) Also in northwestern Wisconsin, mean



Monthly mean discharge of Jump River at Sheldon, Wis. (Drainage area, 574 sq mi; 1,487 sq km)

flow of Chippewa River at Chippewa Falls decreased but remained above the normal range, partly as a result of storm runoff on October 27. Similarly, in eastern and central parts of the State, monthly mean flows of Fox River at Rapide Croche Dam, near Wrightstown, and Wisconsin River at Muscoda, respectively, remained in the above-normal range as a result of high carryover flow from September, augmented by runoff from October rainfall.

In extreme northern Minnesota, mean flow of Rainy River at Manitou Rapids decreased seasonally, remained in the below-normal range for the 6th consecutive month, and was the 2d lowest October mean discharge in 52 years of record as a result of regulation. Also in northern Minnesota, monthly mean flow of Roseau River below State Ditch 51 near Caribou remained below the normal range, was only 11 percent of median, and was the 3d lowest October mean in 61 years of record. In west-central Minnesota, mean discharges of Chippewa River near Milan and Pomme de Terre River at Appleton were above the normal range and were about twice their respective median discharges. Elsewhere in the State, mean flows were in the normal range and generally were less than median except in central Minnesota, where flow of Crow River at Rockford decreased seasonally and remained in the normal range but was 188 percent of the October median.

In western Ontario, monthly mean flow of English River at Umfreville increased seasonally and was greater than median for the first time since January 1980, but remained in the normal range. In the eastern part of the Province, north of Lake Huron, mean flow of Missinaibi

(Continued on page 8.)

Provisional data: subject to revision

SELECTED DATA FOR THE GREAT LAKES, GREAT SALT LAKE, AND OTHER HYDROLOGIC SITES

GREAT LAKES LEVELS

Water levels are expressed as elevations in feet above International Great Lakes Datum 1955

(Data furnished by National Ocean Survey, NOAA, via U.S. Army Corps of Engineers office in Detroit. To convert data to elevations above mean sea level datum of 1929, add the following values: Superior, 0.96; Michigan-Huron, 1.20; St. Clair, 1.24; Erie 1.57; Ontario, 1.22.)

Lake	October 31, 1980	Monthly mean, October		October		
		1980	1979	Average 1900–75	Maximum (year)	Minimum (year)
Superior (Marquette, Mich.)	600.98	600.91	601.29	600.96	601.93 (1951)	599.49 (1925)
Michigan and Huron (Harbor Beach, Mich.)	579.49	579.41	579.56	578.26	580.45 (1973)	575.77 (1964)
St. Clair (St. Clair Shores, Mich.)	574.40	574.73	574.72	573.22	575.35 (1973)	571.13 (1934)
Erie (Cleveland, Ohio)	571.33	571.72	571.68	570.12	572.14 (1973)	567.95 (1934)
Ontario (Oswego, N.Y.)	244.33	244.42	244.75	244.31	246.33 (1945)	241.72 (1934)

GREAT SALT LAKE

Alltime high: 4,211.6 (1873). Alltime low: 4,191.35 (October 1963).	October 31, 1980	October 31, 1979	Reference period 1904–79		
			October average, 1904–79	October maximum (year)	October minimum (year)
Elevation in feet above mean sea level:	4,199.00	4,197.60	4,197.60	4,204.00 (1923)	4,191.35 (1963)

LAKE CHAMPLAIN, AT ROUSES POINT, N.Y.

Alltime high (1827–1977): 102.1 (1869). Alltime low (1939–1977): 92.17 (1941).	October 30, 1980	October 31, 1979	Reference period 1939–78		
			October average, 1939–78	October max. daily (year)	October min. daily (year)
Elevation in feet above mean sea level:	94.77	95.25	94.63	99.04 (1977)	92.90 (1941)

FLORIDA

Site	October 1980		September 1980	October 1979
	Discharge in cfs	Percent of normal	Discharge in cfs	Discharge in cfs
Silver Springs near Ocala (northern Florida)	780	93	767	950
Miami Canal at Miami (southeastern Florida)	52.0	8.4	150	211
Tamiami Canal outlets, 40-mile bend to Monroe	238	43	864	636

(Continued from page 6.)
River at Mattice also increased seasonally and was greater than median for the first time since April 1980 but remained in the normal range. In extreme southeastern Ontario, monthly mean flow of Saugeen River near Port Elgin increased seasonally and remained in the above-normal range for the 4th consecutive month.

In the southern part of Michigan's Lower Peninsula, monthly mean flow of Red Cedar River at East Lansing decreased from the record-high mean flow of September, was 3 times the October median discharge, and remained above the normal range for the 3d consecutive month. In the northern part of the Lower Peninsula, mean discharge of Muskegon River at Evart increased seasonally and was about 1½ times median but was in the normal range. Also in this part of the State, monthly mean levels of Crooked Lake near Conway, Houghton Lake near Houghton Lake Heights, and Lake Mitchell-Cadillac at Cadillac were, respectively, 0.48 foot, 0.33 foot, and 0.27 foot above normal. In the Upper Peninsula, monthly mean flow of Sturgeon River near Sidnaw decreased, contrary to the normal seasonal pattern, but was in the normal range and was about 2 times the October median discharge. Also in the Upper Peninsula, the average monthly level of Lake Michigamme was 0.8 foot above the 25-year median level for October.

In central Ohio, monthly mean flow of Scioto River at Higby decreased seasonally but remained above the normal range for the 5th consecutive month and was 2 times the October median discharge. Storage at monthend in reservoirs in the Scioto River basin upstream from Higby was 89 percent of last month, 70 percent of a year ago, and 68 percent of normal capacity. In the northeastern part of the State, mean flow of Little Beaver Creek near East Liverpool decreased, contrary to the normal seasonal pattern, was 187 percent of median, and was in the normal range, after 4 consecutive months of flow in the above-normal range. Similarly, in the northwestern part of the State, mean flow of Maumee River at Waterville decreased seasonally into the normal range, after 4 months in the above-normal range. Storage at monthend in reservoirs in the Mahoning River basin upstream from Newton Falls was 83 percent of last month, 111 percent of a year ago, and 43 percent of normal capacity.

In Indiana, monthly mean flows decreased in all parts of the State and were in the normal range. For example, in southeastern Indiana, mean discharge of East Fork White River at Shoals decreased seasonally, was 157 percent of median, and was within the normal range after 4 consecutive months of flow in the above-normal range.

In central Illinois, monthly mean flow of Sangamon River at Monticello decreased sharply, was in the below-normal range, and was only 37 percent of median. In the Rock River basin in northern Illinois and the adjacent area of southern Wisconsin, mean flows of Pecatonica River at Freeport and Rock River near Joslin decreased seasonally but remained in the above-normal range and were 1½ and 3½ times the respective October median flows for those stations. Elsewhere in the State, mean flows were within the normal range.

GROUND-WATER CONDITIONS

Ground-water levels in shallow water-table wells in Minnesota declined and continued below average in the southern part of the State, but continued to rise in the northern part; levels were below average in both areas. In the Minneapolis-St. Paul area, artesian levels continued to rise in wells tapping the Prairie du Chien-Jordan and the deeper Mt. Simon-Hinckley aquifers as a result of greatly reduced pumping for air conditioning; levels in both aquifers were above average.

In Wisconsin, levels rose statewide except locally where there was heavy pumping; the greatest rises were in the west-central part of the State.

Levels declined in most areas in Michigan. However, levels continued above average except in south-central and southwestern parts of the Lower Peninsula.

In Illinois, the level in the shallow well in glacial drift at Princeton, Bureau County, declined 1½ feet but continued above average by 4½ feet.

In Indiana, levels held steady statewide and were near average.

Levels declined in Ohio but continued above average in both the northeastern and central parts of the State.

MIDCONTINENT

[Manitoba and Saskatchewan; Arkansas, Iowa, Kansas, Louisiana, Missouri, Nebraska, North Dakota, Oklahoma, South Dakota, and Texas]

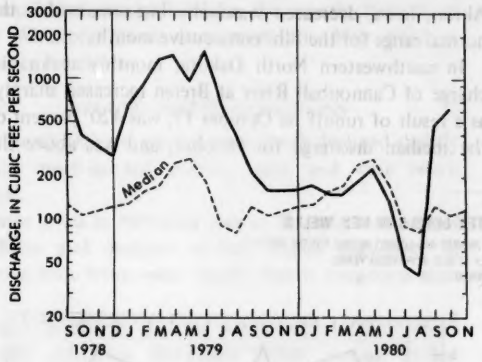
Streamflow increased in Arkansas, Nebraska, Oklahoma, and Texas, decreased in Saskatchewan, Iowa, and Missouri, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Iowa and Texas and increased into that range in parts of Arkansas, Louisiana, North Dakota, and South Dakota. Mean flows persisted in the below-normal range in parts of Kansas, Nebraska, North Dakota, and Oklahoma, and decreased into that range in parts of Missouri.

Ground-water levels declined in North Dakota and in Iowa; mixed trends occurred elsewhere. Levels mostly

were below average in the region except locally in Nebraska, Iowa and Texas. Two new October low levels were reached in Arkansas, and several new October lows occurred in Louisiana.

STREAMFLOW CONDITIONS

In south-central Texas, monthly mean flow of Guadalupe River near Spring Branch increased sharply to 6 times the October median discharge, as a result of runoff from midmonth rains, and remained in the above-normal range. (See graph.) In the western part of



Monthly mean discharge of Guadalupe River near Spring Branch, Texas (Drainage area, 1,315 sq mi; 3,406 sq km)

the State, mean discharge of North Concho River near Carlsbad decreased into the normal range, after 2 consecutive months of mean flow in the above-normal range. Runoff in the extreme northern part of the State was reported to be below the normal range. Monthend records from 38 reservoirs showed that storage decreased in 13 and increased in 25.

In southeastern Louisiana, mean flow of Amite River near Denham Springs increased, contrary to the normal seasonal pattern, was twice the October median discharge, and was in the above-normal range. In the northwestern part of the State, where mean flow of Saline Bayou near Lucky in September was the lowest in the 40-year record, mean discharge increased into the normal range and was 117 percent of the October median, as compared to 17 percent in September. Runoff from rains at midmonth and again near monthend was reported to have relieved the dry conditions that persisted during the summer and fall months. Monthly mean flow of Red River at Alexandria was 30 percent above normal for the month.

In southern Arkansas, monthly mean flow of Saline River near Rye increased sharply, as a result of runoff from rains early in the month, was 424 percent of the median discharge for October, and was above the normal range. Mean flow at this station in September was only 43 percent of median. In the northern part of the State, mean flow of Buffalo River near St. Joe increased into the normal range after 3 consecutive months of flow in the below-normal range, including mean flow during September that was only 22 percent of median.

In Missouri, streamflow was reported to have improved as a result of localized showers. In the southern part of the State, mean discharge of Gasconade River at Jerome decreased, contrary to the normal seasonal patterns, was 54 percent of median, and was in the below-normal range for the 5th time in the past 6 months. However, the 7-day low flows of some headwater streams were reported to have improved from a 10-year recurrence interval in September, to a 2-year interval in October. In the northwestern part of the State, monthly mean discharge of Grand River near Gallatin decreased sharply, was only 10 percent of median, and was below the normal range for the 4th time in the past 6 months.

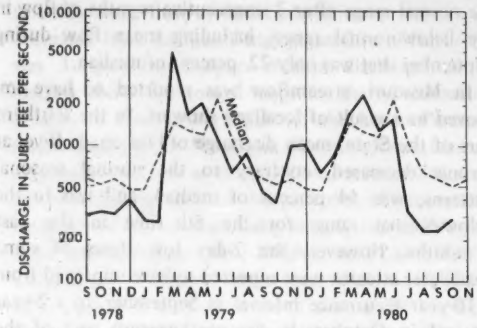
In the adjacent area of southwestern Iowa, mean discharge of Nishnabotna River above Hamburg decreased seasonally and was below median but remained in the normal range for the 5th consecutive month. In north-central Iowa, mean flow of Des Moines River at Fort Dodge also decreased but was in the normal range and was 183 percent of median. In the eastern part of the State, monthly mean flow of Cedar River at Cedar Rapids also decreased but remained above the normal range as a result of high carryover flow from September.

In southwestern Oklahoma, mean discharge of Washita River near Durwood increased, as a result of runoff from rains early in the month, but was only 29 percent of median and remained in the below-normal range for the 3d consecutive month. Oklahoma was reported to have qualified for Federal drought aid, and water rationing plans were implemented in many communities. Reservoir storage at monthend generally was below average for the month.

In Kansas, streamflow increased in some parts of the State and decreased in others, but was in the below-normal range at all index stations. For example, mean flow of Arkansas River at Arkansas City, in the southwestern part of the State, increased slightly as a result of storm runoff on October 20, but remained below the normal range and was only 19 percent of median. Similarly, in the northeastern part of the State, mean flow of Little Blue River near Barnes increased as a result of runoff on October 19, but remained below the normal range for the 4th consecutive month. In northwestern Kansas, monthly mean discharge of Saline River near Russell decreased seasonally and was below the

normal range again, after 2 consecutive months of flow within the normal range.

In northeastern Nebraska, mean flow of Elkhorn River at Waterloo increased, contrary to the normal seasonal pattern, but remained in the below-normal range for the 4th consecutive month and was only 56 percent of median. (See graph.) By contrast, in the Nebraska Panhandle, mean discharge of Niobrara River above Box Butte Reservoir increased seasonally, was 134 percent of median, and remained in the normal range for the 5th consecutive month. Flow of North Platte River, also in the Panhandle, was reported to be in the normal range. In the Republican River basin in southwestern Nebraska, unregulated streamflow was reported to be much below-normal and below-normal flows also were observed in the Loup River basin in central Nebraska.



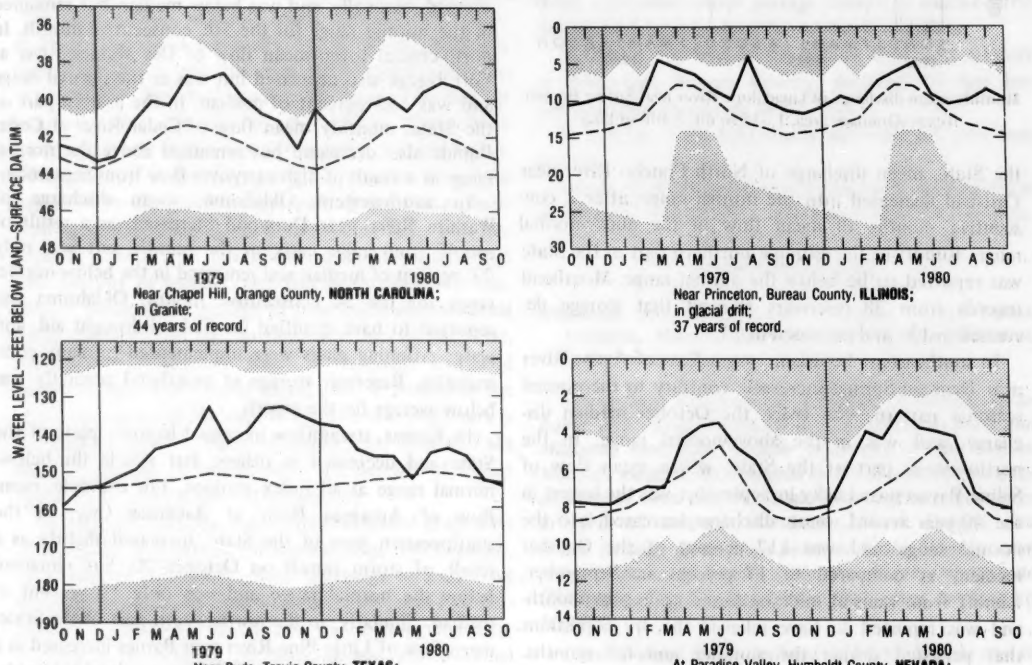
Monthly mean discharge of Elkhorn River at Waterloo, Nebr. (Drainage area, 6,900 sq mi; 17,900 sq km)

In central South Dakota, flow occurred in Bad River near Fort Pierre at midmonth resulting in monthly mean discharge in the above-normal range. This was the first flow observed at this station since July 15. In the eastern part of the State, mean flow of Big Sioux River at Akron, Iowa, decreased seasonally but remained in the normal range for the 8th consecutive month.

In southwestern North Dakota, monthly mean discharge of Cannonball River at Breien increased sharply, as a result of runoff on October 17, was 420 percent of the median discharge for October, and was above the

MONTH-END GROUND-WATER LEVELS IN KEY WELLS

UNSHADED AREA INDICATES RANGE BETWEEN HIGHEST AND LOWEST RECORD FOR THE MONTH
DOTTED LINE INDICATES AVERAGE OF MONTHLY LEVELS, IN PREVIOUS YEARS
HEAVY LINE INDICATES LEVEL FOR CURRENT PERIOD



Near Chapel Hill, Orange County, **NORTH CAROLINA**; in Granite; 44 years of record.

Near Princeton, Bureau County, **ILLINOIS**; in glacial drift; 37 years of record.

Near Buda, Travis County, **TEXAS**; in Edwards Limestone; 36 years of record.

At Paradise Valley, Humboldt County, **NEVADA**; in Quaternary alluvium; 34 years of record.

normal range for the first time since January 1980. In the eastern part of the State, mean flow of Red River of the North at Grand Forks decreased sharply, was only one-third the median discharge for the month, and remained below the normal range for the 6th consecutive month.

In southeastern Saskatchewan, monthly mean flow of Qu'Appelle River near Lumsden decreased seasonally but was 164 percent of the median discharge for October and was in the normal range.

In southwestern Manitoba, the level of Lake Winnipeg at Gimli averaged 713.87 feet above mean sea level for the month, 0.01 foot lower than last month, 0.42 foot lower than a year ago, 0.25 foot higher than the long-term mean for October, and 2.54 feet lower than the maximum average level for the month. Records of Lake Winnipeg levels were started in May 1913 at Winnipeg Beach.

GROUND–WATER CONDITIONS

In North Dakota, ground-water levels declined slightly despite much-needed soaking rains, and were below normal.

Water levels in Nebraska rose in the irrigated parts of the State and declined or held steady elsewhere. At month's end, levels were mostly below long-term averages.

Water levels in shallow water-table wells in Iowa declined statewide and were below average in the northeast and southwest corners of the State.

In Kansas, levels declined in key wells in the northwestern and northeastern parts of the State, and were below average. In the south-central part, levels rose in the Sedwick County well and declined in the Harvey County well; levels in both were below average.

In Arkansas, in the rice-growing part of the State, the level in the key well in the shallow Quaternary aquifer rose slightly and continued below average by more than 7 feet; despite the rise, the level was at a new October low in 51 years of record. The level in the well in the deep Sparta Sand aquifer rose more than 32 feet in continued response to the earlier cessation of continuous pumping caused by recent drought conditions. In the key industrial aquifer of central and southern Arkansas—the Sparta Sand—the level in the well at Pine Bluff declined about 2½ feet and was about 42 feet below average, reaching a new October low in 22 years of record.

In Louisiana, water levels in the Chicot aquifer in the southwest continued to recover; however, levels in wells in several parishes were significantly below previous record lows for October. Levels generally declined in the Lake Charles industrial area—about 6 feet in the northern part and 2½ feet in the southern part. Levels in the Evangeline aquifer rose nearly a foot at Opelousas and declined nearly 3 feet near Eunice. In northern and central Louisiana, levels in wells in the Sparta Sand and in the Miocene sands continued to decline. In many wells, levels were at record lows. Seasonal declines occurred in wells in the Wilcox, Cockfield, terrace, and alluvial aquifers.

In Texas, in the artesian Edwards limestone aquifer, the level in the key well at Austin declined but was above average, whereas the level in the well at San Antonio rose but was below average. The artesian level in the key well in the Evangeline aquifer at Houston rose but was below average. In the bolson deposits at El Paso, the level in the key well also rose but was below average.

WEST

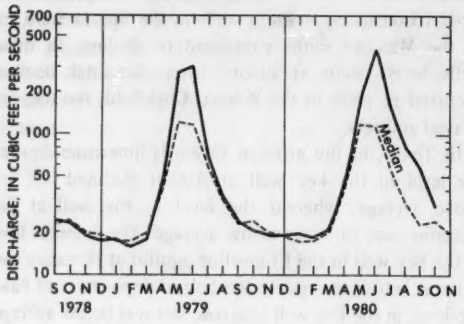
[Alberta and British Columbia; Arizona, California, Colorado, Idaho, Montana, Nevada, New Mexico, Oregon, Utah, Washington, and Wyoming]

Streamflow generally decreased seasonally in Alberta and New Mexico, increased seasonally in Oregon and Nevada, and was variable elsewhere in the region. Monthly mean flows remained in the above-normal range in parts of Arizona, California, Montana, Nevada, and Utah, and increased into that range in parts of Alberta. Mean flows remained in the below-normal range in parts of Arizona, New Mexico, Oregon, and Utah, and decreased into that range in parts of Idaho and Washington.

Ground-water levels rose in Washington and declined in Montana and Arizona; trends were mixed elsewhere in the region. Levels were below average in Washington, Idaho, Arizona, and New Mexico, and mixed with respect to average in other States. New high levels for October were recorded in southern California, Nevada, and Utah, and new lows for October occurred in Idaho, Utah, Arizona, and New Mexico. Three new alltime low levels were reported in Arizona.

STREAMFLOW CONDITIONS

In southwestern Utah, where monthly mean discharge of Beaver River near Beaver was highest of record for the period June to September, flow decreased to 128 percent of median in October but remained in the above-normal range. (See graph on page 12.) By contrast, in the southeastern part of the State, monthly mean flow of San Juan River near Bluff decreased sharply to only 37 percent of median and was below the normal range. Similarly, in east-central Utah, mean flow of Green River at Green River increased seasonally to 60 percent of median but remained in the below-normal range for the



Monthly mean discharge of Beaver River near Beaver, Utah (Drainage area, 90.7 sq mi; 235 sq km)

3d consecutive month. Elsewhere in the State, mean flows at index stations generally decreased seasonally and remained in the normal range.

Contents of the Colorado River Storage Project decreased 562,900 acre-feet during the month.

In central Arizona, monthly mean flow of Verde River below Tangle Creek, above Horseshoe Dam, increased contrary to the normal seasonal pattern of decreasing flow, and was above the normal range. In the Virgin River basin in northwestern Arizona and the adjacent areas of Nevada and Utah, mean discharge of Virgin River at Littlefield, Ariz., decreased to 184 percent of median but remained in the above-normal range. In the southern part of the State, mean discharge of San Pedro River at Charleston increased slightly to 48 percent of median, and remained in the below-normal range for the 4th consecutive month. In the north-central part of the State, there was no flow in the Little Colorado River near Cameron for the entire month. Elsewhere in the State, monthly mean flows at index stations on the Gila and Salt Rivers were within the normal range. Storage in major reservoirs changed only slightly during October.

In northern New Mexico, monthly mean discharge of Rio Grande below Taos Junction Bridge, near Taos, decreased in contrast to the normal seasonal pattern of increasing flow, and remained in the below-normal range for the 2d consecutive month. Elsewhere in the State, mean flows at index staions decreased seasonally, ranged from 80 to 113 percent of median, and were within the normal range.

In west-central Colorado, monthly mean discharge of Roaring Fork River at Glenwood Springs increased seasonally, was 111 percent of median, and remained in the normal range for the 3d consecutive month. Elsewhere in the State, monthly mean flows at index stations were below median but remained in the normal range for the 4th consecutive month.

In southern Wyoming, mean flow of North Platte River above Seminoe Reservoir, near Sinclair, increased seasonally to 102 percent of median, and remained in the normal range for the 5th consecutive month. In the northern part of the State, monthly mean discharge of Tongue River near Dayton decreased seasonally, remained in the normal range, and was below median for the 20th consecutive month.

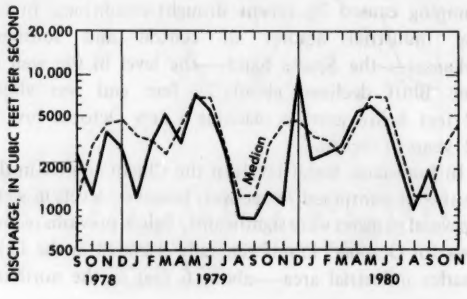
In south-central Montana, monthly mean discharge of Yellowstone River at Billings continued to increase, contrary to the normal seasonal pattern, was 152 percent of median, and remained in the above-normal range for the 2d consecutive month. Elsewhere in the State, monthly mean flows increased at some index stations and decreased at others, and ranged from 107 to 114 percent of their respective median flows.

In south-central Idaho, where monthly mean discharge of Snake River at Weiser was above the normal range in September, flow decreased to 89 percent of median and was below the normal range in October. Streamflow decreased at the remaining index stations in Idaho during October and was below median but within the normal range. Reservoir storage in southern Idaho was above average.

In southwestern Alberta, the seasonal decrease in flow of Bow River at Banff was less than the normal amount and monthly mean flow at that site increased from the normal to the above-normal range in October.

In northern British Columbia, mean flow of Skeena River at Usk increased seasonally to 126 percent of median but remained in the normal range for the 3d consecutive month. In the southern part of the Province, monthly mean discharge in Fraser River at Hope decreased seasonally, was slightly less than median, and remained within the normal range.

In northwestern Washington, where monthly mean flow of Skykomish River near Gold Bar was above the normal range and 154 percent of median during September, flow decreased sharply to only 31 percent of median and was below the normal range in October. (See graph.) In the lowlands of southwestern



Monthly mean discharge of Skykomish River near Gold Bar, Wash. (Drainage area, 535 sq mi; 1,386 sq km)

Washington, monthly mean discharge in Chehalis River near Grand Mound decreased to only 28 percent of median and was below the normal range for the first time since May 1980. In Spokane River basin, in eastern Washington and the adjacent area of northern Idaho, mean flow of Spokane River at Spokane, Washington, increased seasonally but was below the normal range, following 4 consecutive months of flow in the normal range.

In north-central Oregon, monthly mean flow of John Day River at Service Creek continued to increase seasonally and was near the median flow for October. In the western part of the State, mean flows of Willamette River at Salem and Umpqua River near Elkton increased seasonally, were 43 and 73 percent of their respective median flows, and remained in the below-normal range for the 3d consecutive month.

In north-central Nevada, mean flow in Humboldt River at Palisade increased seasonally to 209 percent of median, and remained in the above-normal range for the 6th consecutive month.

In California, streamflow in most areas of the State was within the normal range; however, monthly mean discharges of Arroyo Seco near Pasadena and Kings River above North Fork, near Trimmer, in the southern half of the State, were above the normal range and remained above the median flow for the 10th consecutive month. Combined contents of 10 index reservoirs in northern and central California were 128 percent of average and, as in September, were 120 percent of the contents one year ago.

GROUND-WATER CONDITIONS

In Washington, the artesian ground-water level in the key well in Tacoma, in the western part of the State, rose slightly but was below average by nearly 13 feet. The level in the well in Spokane Valley, in eastern Washington, also rose slightly, but was nearly 3½ feet below average.

In Idaho, the level in the sand and gravel water-table aquifer in the Boise Valley continued its seasonal decline and was at the average level for October. In the non-artesian observation wells representative of the conditions in the Snake River Plain aquifer, levels rose in three wells and held steady in one. The levels in the wells at Eden and Rupert were at new October lows in 23 and 30 years of record, respectively. The level in the well at Atomic City equalled the October low level reached a year ago. The level in the water-table well in the alluvial aquifer underlying the Rathdrum Prairie, in northern Idaho, held steady but continued below average by about 9 feet.

Levels in the key water-table wells in Montana declined. The level at Missoula was above average, and the level at Hamilton Fairgrounds was slightly above average.

In southern California, among the three key wells in Santa Barbara County, the level in the well in the Santa Ynez Valley rose slightly but was below average. The level in the well in Upper Cuyama Valley declined 3.85 feet, but nevertheless was at a new October high in 30 years of record. The level in the Santa Maria Valley declined 6 feet but was more than 3 feet above average. Levels declined 3½ feet in the Baldwin park well in Los Angeles County, and rose slightly in the Los Alamitos well in Orange County; levels were nearly 6 or more than 3½ feet below average in these wells, respectively.

In Nevada, the artesian levels in the key wells in Las Vegas Valley and Steptoe Valley rose; the level in the former was below average, and the level in the latter reached a new high for October in 30 years of record. In Paradise Valley, the level in the key well declined but was above average, while the level in the well at Truckee Meadows declined and was below average.

In Utah, levels generally declined except in the Holladay area where, despite a rise of 6½ feet, the level in the key well was at a new October low in 32 years of record. The levels were below average in the Flowell area, and above average in the Logan area. Despite a slight decline in the well in the Blanding area, the level was at a new high for October in 20 years of record.

In Arizona, water levels declined in three index wells and rose in two. The level in the well in the Elfrida area reached a new October low in 29 years of record, and the level in the City of Tucson No. 2 well reached a new alltime low in 12 years of record. A new alltime low was reported also in another observation well.

In New Mexico, the level in the Berrendo-Smith observation well rose but was below average. Although the level in the Dayton well rose very slightly, the level was at a new October low in 42 years of record. Levels in the Hrna and Lovington wells declined and were below average.

ALASKA

In southeastern Alaska, monthly mean discharge increased sharply in Gold Creek at Juneau and was above the normal range as a result of runoff from above-normal precipitation. In the south-coastal part of the State, local flooding occurred in small streams on Kenai Peninsula near Homer as a result of rapid runoff from intense rains near monthend. Monthly mean flow of Kenai River at Cooper Landing increased sharply into the above-normal range and was 193 percent of median. The daily mean discharge of 12,000 cfs at this station on October 30

was only 8 percent less than the maximum daily mean for October in record than began in 1948. In the interior, monthly mean flows of Chena River at Fairbanks and Tanana River at Nenana decreased seasonally and remained in the normal range for the 4th consecutive month. In south-central Alaska, monthly mean discharge of Little Susitna River near Palmer decreased sharply into the normal range, after 3 consecutive months in the above-normal range including a record-high daily mean discharge on September 15, but remained above median for the 13th consecutive month.

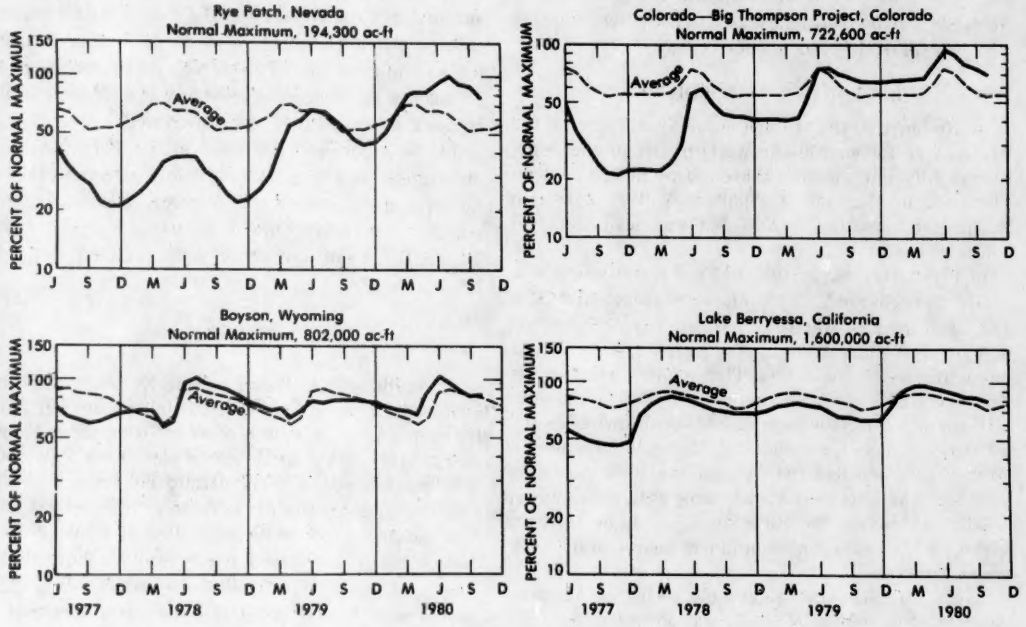
Ground-water levels in confined aquifers in the Anchorage area rose as much as 1 to 2 feet, although changes in pumping patterns of large supply wells caused some levels to rise or fall 5 feet or more. Overall, recharge to the aquifer system probably exceeded discharge. Levels in the unconfined aquifer were generally higher than last month.

HAWAII

On the island of Hawaii, monthly mean flow of Waiakea Stream near Mountain View decreased seasonally but remained in the above-normal range and was 162 percent of median. On the island of Maui, mean flow of Honopou Stream near Huelo decreased, contrary to the normal seasonal pattern, was in the normal range, and was 165 percent of the October median discharge. On the islands of Kauai and Oahu, monthly mean flows of North Fork Wailua Stream near Lihue, and Kalihi Stream near Honolulu, respectively, decreased contrary to the normal seasonal pattern, were in the normal range, and were slightly less than median.

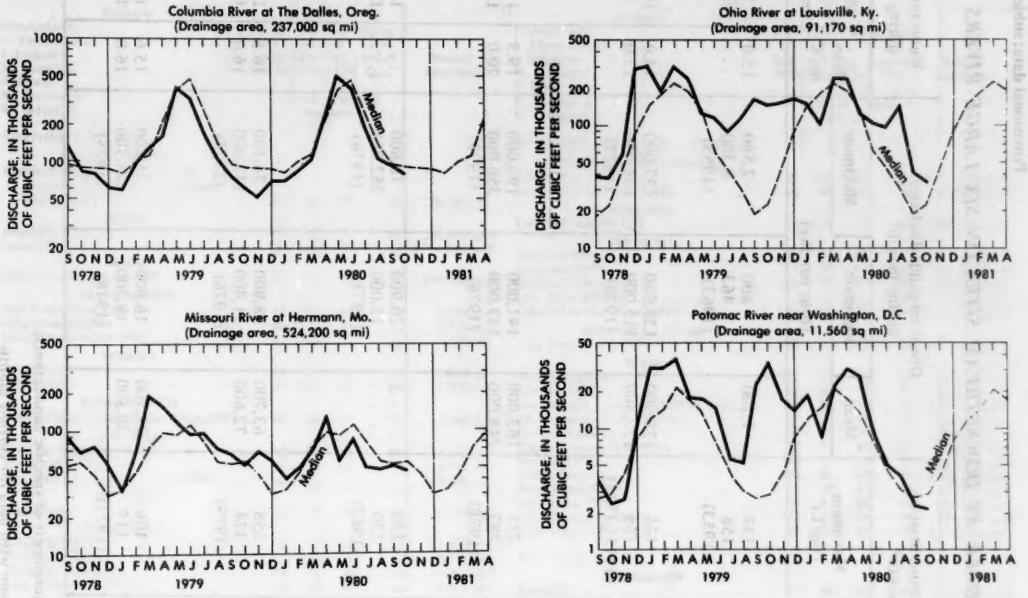
On Guam, Mariana Islands, monthly mean flow of Ylig River near Yona also decreased, was in the normal range, and was 114 percent of the October median discharge.

USABLE CONTENTS OF SELECTED RESERVOIRS AND RESERVOIR SYSTEMS, JUNE 1977 TO OCTOBER 1980



Above-average contents continued to characterize most reservoirs in the West during October, including all of the reservoirs and reservoir systems shown on the above graphs.

HYDROGRAPHS OF FOUR LARGE RIVERS



DISSOLVED SOLIDS AND WATER TEMPERATURES FOR OCTOBER ON SIX LARGE RIVERS

The table on page 16 shows dissolved-solids and temperature data for October at six stream-sampling sites that are part of the National Stream Quality Accounting Network (NASQAN). NASQAN, as established by the U.S. Department of the Interior, Geological Survey, is designed to describe the water quality of the Nation's streams and rivers on a systematic and continuing basis, so as to meet many of the information needs of those involved in national or regional water-quality planning and management.

"Dissolved solids," as described in several columns of the table, are minerals dissolved in water and usually consist predominantly of silica and ions of calcium, magnesium, sodium, potassium, carbonate, bicarbonate, sulfate, chloride, and nitrate. These same minerals are among the most common components of the Earth's solid rocks and minerals, but gradually erode and at least partly dissolve as a part of natural weathering processes. Collectively these and other dissolved minerals constitute the dissolved-solids concentration expressed in milligrams per liter (mg/L) or the generally equivalent expression, parts per million (parts of dissolved matter in one million parts of water, by weight). Values of dissolved solids are convenient for comparing the quality of water from one time to another and from one place to another. Most drinking water contains between 50 and 500 mg/L of dissolved solids.

"Dissolved-solids discharge," expressed in tons per day, represents the total daily amount of dissolved minerals carried by the stream and is calculated by multiplying the dissolved-solids concentration (in mg/L) by the stream discharge (in cfs; times a unit conversion factor of .0027). Even though dissolved-solids *concentrations* are generally higher during periods of low streamflow than of high streamflow, the highest dissolved-solids *discharges* occur during periods of high streamflow because the total quantities of water, and therefore total load of dissolved minerals, are so much greater than at times of low flow.

Provisional data; subject to revision

DISSOLVED SOLIDS AND WATER TEMPERATURES FOR OCTOBER AT DOWNSTREAM SITES ON SIX LARGE RIVERS

Station number	Station name	October data of following calendar years	Stream discharge during month	Dissolved-solids concentration during month[a]		Dissolved-solids discharge during month[a]			Water temperature during month[b]		
			Mean (cfs)	Minimum (mg/L)	Maximum (mg/L)	Mean	Minimum	Maximum	Mean, in °C	Minimum, in °C	Maximum, in °C
						(tons per day)					
	NORTHEAST										
01463500	Delaware River at Trenton, N.J. (Morrisville, Pa.)	*1980	3,500	108	139	1,200	800	2,560	15.0	9.5	20.0
		1944–79 (Extreme yr)	6,942	58 (1945)	156 (1953)	.....	463 (1963)	8,300 (1955)	.....	8.5	25.5
			[c]4,025								
04264331	St. Lawrence River at Cornwall, Ontario, near Massena, N.Y. median streamflow at Ogdensburg, N.Y.	1980	296,000	165	166	128,000	125,000	133,000	14.0	10.5	17.0
		1975–79 (Extreme yr)	289,400	165 (1979)	168 (1975–1977)	130,000	115,000 (1978)	138,000 (1977)	13.0	0	17.0
			[c]234,500								
	SOUTHEAST										
07289000	Mississippi River at Vicksburg, Miss.	1980	266,200	207	271	163,000	141,000	193,000	19.5	16.0	22.0
		1975–79 (Extreme yr)	413,900	183 (1979)	282 (1978)	248,000	117,000 (1976)	356,000 (1979)	20.0	15.0	26.0
			[c]264,200								
	WESTERN GREAT LAKES REGION										
03612500	Ohio River at lock and dam 53, near Grand Chain, Ill. (25 miles west of Paducah, Ky.; streamflow station at Metropolis, Ill.)	1980	75,400	150	239	.....	20,900	76,800	.....	18.0	18.5
		1954–79 (Extreme yr)	123,700	135 (1960,1963)	330 (1967)	.....	15,000 (1973)	262,000 (1976)	.....	12.0	26.0
			[c]89,100								
	MIDCONTINENT										
06934500	Missouri River at Hermann, Mo. (60 miles west of St. Louis, Mo.)	1980	45,700	489	558	63,700	58,900	74,100	16.5	11.0	22.5
		1975–79 (Extreme yr)	67,240	236 (1977)	474 (1979)	72,600	51,800 (1976)	142,000 (1975)	16.0	10.0	22.0
			[c]55,340								
	WEST										
14128910	Columbia River at Warrendale, Oreg. (streamflow station at The Dalles, Oreg.)	1980	101,000	96	106	27,700	16,000	35,200	15.6	14.0	17.5
		1975–79 (Extreme yr)	117,800	78 (1976)	117 (1977)	30,500	18,200 (1978)	48,900 (1975)	16.0	14.0	19.5
			[c]100,400								

[a]Dissolved-solids concentrations when not analyzed directly, are calculated on basis of measurements of specific conductance.
[b]To convert °C to °F: [(1.8 X °C) + 32] = °F.
[c]Median of monthly values for 30-year reference period, water years 1941–70, for comparison with data for current month.
*Dissolved-solids and water-temperature records not available.

Provisional data; subject to revision

USABLE CONTENTS OF SELECTED RESERVOIRS NEAR END OF OCTOBER 1980

[Contents are expressed in percent of reservoir capacity. The usable storage capacity of each reservoir is shown in the column headed "Normal maximum."]

Reservoir Principal uses: F Flood control I Irrigation M Municipal P Power R Recreation W Industrial	End of Sept. 1980	End of Oct. 1980	End of Oct. 1979	Average for end of Oct.	Normal maximum
	Percent of normal maximum				
NORTHEAST REGION					
NOVA SCOTIA					
Rossignol, Mulgrave, Falls Lake, St. Margaret's Bay, Black, and Ponhook Reservoirs (P)	45	40	57	35	226,300 (a)
QUEBEC					
Allard (P)	91	91	71	65	280,600 ac-ft
Gouin (P)	72	81	78	55	6,954,000 ac-ft
MAINE					
Seven reservoir systems (MP)	52	53	54	52	178,500 mcf
NEW HAMPSHIRE					
First Connecticut Lake (P)	75	71	63	74	3,330 mcf
Lake Francis (FPR)	78	80	73	76	4,326 mcf
Lake Winnipesaukee (PR)	76	64	82	55	7,220 mcf
VERMONT					
Harriman (P)	66	67	74	61	5,060 mcf
Somerset (P)	73	76	76	69	2,500 mcf
MASSACHUSETTS					
Cobble Mountain and Borden Brook (MP)	69	66	75	71	3,394 mcf
NEW YORK					
Great Sacandaga Lake (FPR)	62	93	61	56	34,270 mcf
Indian Lake (FMP)	86	90	107	55	4,500 mcf
New York City reservoir system (MW)	56	45	82		547,500 mg
NEW JERSEY					
Wanaque (M)	47	38	91	65	27,730 mg
PENNSYLVANIA					
Allegheny (FPR)	41	32	37	32	51,400 mcf
Pymatuning (FMR)	81	78	98	78	8,191 mcf
Raystown Lake (FR)	59	52	68	49	33,190 mcf
Lake Wallenpaupack (PR)	64	48	59	48	6,875 mcf
MARYLAND					
Baltimore municipal system (M)	86	82	100	85	85,340 mg
SOUTHEAST REGION					
NORTH CAROLINA					
Bridgewater (Lake James) (P)	90	87	94	80	12,580 mcf
Narrows (Badin Lake) (P)	85	90	78	95	5,616 mcf
High Rock Lake (P)	56	39	70	59	10,230 mcf
SOUTH CAROLINA					
Lake Murray (P)	82	83	82	62	70,300 mcf
Lakes Marion and Moultrie (P)	70	94	72	65	81,100 mcf
SOUTH CAROLINA--GEORGIA					
Clark Hill (FP)	66	64	72	54	75,360 mcf
GEORGIA					
Burton (PR)	89	87	85	66	104,000 ac-ft
Sinclair (MPR)	86	75	97	76	214,000 ac-ft
Lake Sidney Lanier (FMPR)	51	48	61	52	1,686,000 ac-ft
ALABAMA					
Lake Martin (P)	85	85	84	66	1,373,000 ac-ft
TENNESSEE VALLEY					
Clinch Projects: Norris and Melton Hill Lakes (FPR)	31	24	37	33	1,156,000 cfsd
Douglas Lake (FPR)	25	18	51	24	703,100 cfsd
Hiwassee Projects: Chatuge, Nottely, Hiwassee, Apalachia, Blue Ridge, Ocoee 3, and Parksville Lakes (FPR)	56	54	60	49	510,300 cfsd
Holston Projects: South Holston, Watauga, Boone, Fort Patrick Henry, and Cherokee Lakes (FPR)	43	39	56	39	1,452,000 cfsd
Little Tennessee Projects: Nantahala, Thorpe, Fontana, and Chilhowee Lakes (FPR)	54	45	68	48	745,200 cfsd
WESTERN GREAT LAKES REGION					
WISCONSIN					
Chippewa and Flambeau (PR)	94	95	84	77	15,900 mcf
Wisconsin River (21 reservoirs) (PR)	92	92	60	63	17,400 mcf
MINNESOTA					
Mississippi River headwater system (FMR)	24	21	26	29	1,640,000 ac-ft
MIDCONTINENT REGION					
NORTH DAKOTA					
Lake Sakakawea (Garrison) (FIPR)	81	81	90	91	22,700,000 ac-ft
SOUTH DAKOTA					
Angostura (I)	66	66	90	73	127,600 ac-ft
Bell Fourche (I)	15	19	30	35	185,200 ac-ft
Lake Francis Case (FIP)	73	60	63	57	4,834,000 ac-ft
Lake Oahe (FIP)	73	72	86		22530,000 ac-ft
MIDCONTINENT REGION Continued					
SOUTH DAKOTA--Continued					
Lake Sharpe (FIP)	98	103	103	94	1,725,000 ac-ft
Lewis and Clarke Lake (FIP)	94	96	102	95	477,000 ac-ft
NEBRASKA					
Lake McConaughy (IP)	72	74	73	66	1,948,000 ac-ft
OKLAHOMA					
Eufaula (FPR)	76	74	89	84	2,378,000 ac-ft
Keystone (FPR)	73	75	84	87	661,000 ac-ft
Tenkiller Ferry (FPR)	84	83	97	89	628,200 ac-ft
Lake Altus (FIMR)	22	21	62	49	133,000 ac-ft
Lake O'The Cherokees (FPR)	70	72	74	81	1,492,000 ac-ft
OKLAHOMA--TEXAS					
Lake Texoma (FMPRW)	80	87	92	92	2,722,000 ac-ft
TEXAS					
Bridgeport (IMW)	21	27	40	44	386,400 ac-ft
Canyon (FMR)	91	93	90	71	385,600 ac-ft
International Amistad (FIMPW)	85	90	123	85	3,497,000 ac-ft
International Falcon (FIMPW)	72	73	94	78	2,668,000 ac-ft
Livingston (IMW)	84	84	99	77	1,788,000 ac-ft
Possum Kingdom (IMPRW)	77	95	89	101	570,200 ac-ft
Red Bluff (PI)	10	21	23	27	307,000 ac-ft
Toledo Bend (P)	84	81	88	76	4,472,000 ac-ft
Twin Buttes (FIM)	34	37	43	30	177,800 ac-ft
Lake Kemp (IMW)	36	42	50	86	268,000 ac-ft
Lake Meredith (FMW)	23	21	29	38	821,300 ac-ft
Lake Travis (FIMPRW)	85	106	85	79	1,144,000 ac-ft
THE WEST					
WASHINGTON					
Ross (PR)	92	89	91	85	1,052,000 ac-ft
Franklin D. Roosevelt Lake (IP)	100	98	93	103	5,022,000 ac-ft
Lake Chelan (PR)	88	78	72	73	676,100 ac-ft
Lake Cushman	94	90	99	86	359,500 ac-ft
Lake Merwin (P)	103	99	105	85	245,600 ac-ft
IDAHO					
Boise River (4 reservoirs) (FIP)	60	60	38	47	1,235,000 ac-ft
Coeur d'Alene Lake (P)	77	57	56	54	238,500 ac-ft
Pend Oreille Lake (FP)	86	55	56	71	1,561,000 ac-ft
IDAHO--WYOMING					
Upper Snake River (8 reservoirs) (MP)	57	58	38	49	4,401,000 ac-ft
WYOMING					
Boysen (FIP)	83	82	79	82	802,000 ac-ft
Buffalo Bill (IP)	74	73	51	74	421,300 ac-ft
Keyhole (F)	54	52	77	45	190,400 ac-ft
Pathfinder, Seminoe, Alcova, Kortes, Glendo, and Guernsey Reservoirs (I)	56	57	54	43	3,056,000 ac-ft
COLORADO					
John Martin (FIR)	13	10	1	11	364,400 ac-ft
Taylor Park (IR)	76	56	78	54	106,200 ac-ft
Colorado Big Thompson project (I)	76	71	65	54	722,600 ac-ft
COLORADO RIVER STORAGE PROJECT					
Lake Powell; Flaming Gorge, Fontenelle, Navajo, and Blue Mesa Reservoirs (IFPR)	91	89	83		31,620,000 ac-ft
UTAH--IDAHO					
Bear Lake (IPR)	83	79	67	57	1,421,000 ac-ft
CALIFORNIA					
Folsom (FIP)	69	63	67	53	1,000,000 ac-ft
Hetch Hetchy (MP)	83	70	61	48	360,400 ac-ft
Isabella (FIR)	61	48	37	22	568,100 ac-ft
Pine Flat (FI)	69	69	50	36	1,001,000 ac-ft
Clair Engle Lake (Lewiston) (P)	78	76	67	68	2,438,000 ac-ft
Lake Almanor (P)	94	89	64	48	1,036,000 ac-ft
Lake Berryessa (FIMW)	83	81	64	73	1,600,000 ac-ft
Millerton Lake (FI)	58	41	35	32	503,200 ac-ft
Shasta Lake (FIPR)	74	74	73	63	4,377,000 ac-ft
CALIFORNIA--NEVADA					
Lake Tahoe (IPR)	56	83	11	48	744,600 ac-ft
NEVADA					
Rye Patch (I)	89	79	47	49	194,300 ac-ft
ARIZONA--NEVADA					
Lake Mead and Lake Mohave (FIMP)	90	89	85	69	27,970,000 ac-ft
ARIZONA					
San Carlos (IP)	66	64	76	13	1,073,000 ac-ft
Salt and Verde River system (IMPR)	75	73	76	35	2,073,000 ac-ft
NEW MEXICO					
Conchas (FIR)	40	35	43	82	330,100 ac-ft
Elephant Butte and Caballo (FIPR)	49	48	34	25	2,453,000 ac-ft

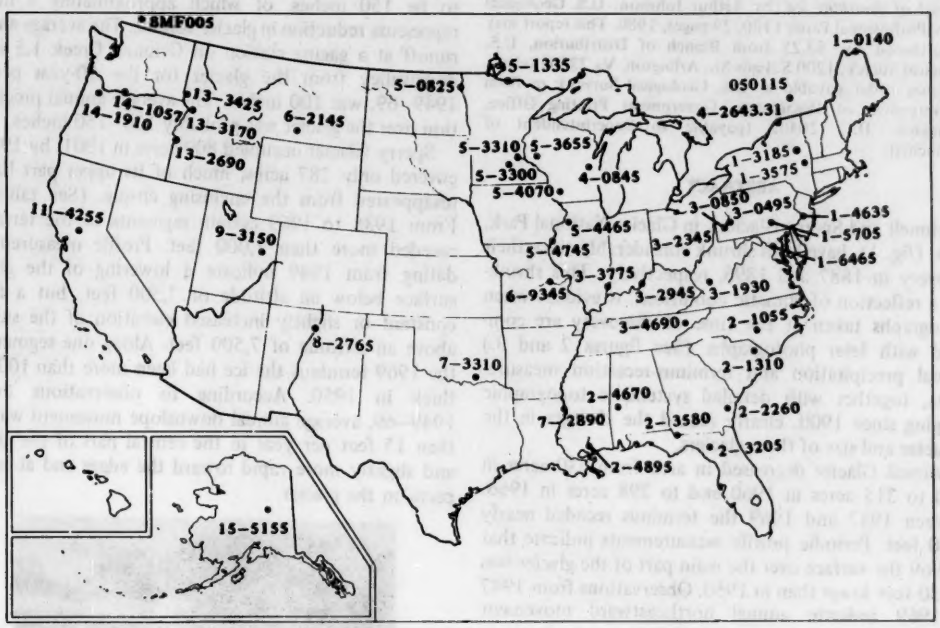
[a]Thousands of kilowatt-hours (the potential electric power that could be generated by the volume of water in storage).

FLOW OF LARGE RIVERS DURING OCTOBER 1980

Station number*	Stream and place of determination	Drainage area (square miles)	Mean annual discharge through September 1975 (cfs)	October 1980					
				Monthly discharge (cfs)	Percent of median monthly discharge, 1941–70	Change in discharge from previous month (percent)	Discharge near end of month		
							(cfs)	(mgd)	Date
1–0140	St. John River below Fish River at Fort Kent, Maine	5,690	9,549	8,540	182	+59	8,600	5,560	31
1–3185	Hudson River at Hadley, N.Y	1,664	2,853	1,020	85	+27	1,500	970	31
1–3575	Mohawk River at Cohoes, N.Y	3,456	5,630	2,100	92	+56	11,000	7,110	27
1–4635	Delaware River at Trenton, N.J	6,780	11,630	3,240	80	-8	3,150	2,040	28
1–5705	Susquehanna River at Harrisburg, Pa	24,100	34,200	4,450	57	+1	11,800	7,630	28
1–6465	Potomac River near Washington, D.C	11,560	[1] 11,190	2,180	77	-4	3,100	2,000	31
2–1055	Cape Fear River at William O. Huske Lock near Tarheel, N.C	4,810	5,007	1,460	69	+53	769	497	31
2–1310	Pee Dee River at Peedee, S.C	8,830	9,657	4,500	97	+46	29,700	19,200	27
2–2260	Altamaha River at Doctortown, Ga	13,600	13,780	3,100	59	+14	2,550	1,650	28
2–3205	Suwannee River at Branford, Fla	7,880	6,970	3,040	66	-15	3,360	2,170	31
2–3580	Apalachicola River at Chattahoochee, Fla	17,200	22,330	8,450	77	-13	8,360	5,400	31
2–4670	Tombigbee River at Demopolis lock and dam near Coatopa, Ala	15,400	22,570	9,110	340	+182	22,800	14,700	30
2–4895	Pearl River near Bogalusa, La	6,630	9,263	2,290	115	-15	4,030	2,600	31
3–0495	Allegheny River at Natrona, Pa	11,410	[1] 19,210	6,070	139	-44	8,260	5,340	24
3–0850	Monongahela River at Braddock, Pa	7,337	[1] 12,360	2,930	93	-92	2,150	1,390	24
3–1930	Kanawha River at Kanawha Falls, W.Va	8,367	12,530	4,170	92	-13	6,130	3,960	29
3–2345	Scioto River at Higby, Ohio	5,131	4,513	1,170	201	-53	1,510	980	27
3–2945	Ohio River at Louisville, Ky[2]	91,170	114,100	35,700	159	-16	65,900	42,600	26
3–3775	Wabash River at Mount Carmel, Ill	28,635	27,030	7,021	138	-34	7,500	4,850	31
3–4690	French Broad River below Douglas Dam, Tenn	4,543	[1] 6,794	2,500	71	+4	.....	.....	.....
4–0845	Fox River at Rapide Croche Dam, near Wrightstown, Wis[2]	6,150	4,185	3,990	187	-7	.....	.....	.....
02MC002 (4–2643.31)	St. Lawrence River at Cornwall, Ontario–near Massena, N.Y[3]	299,000	241,100	286,500	122	-5	284,000	184,000	31
050115	St. Maurice River at Grand Mere, Quebec	16,300	25,300	36,500	201	+73	33,600	21,700	31
5–0825	Red River of the North at Grand Forks, N. Dak	30,100	2,524	455	33	-40	580	375	31
5–1335	Rainy River at Manitou Rapids, Minn	19,400	12,950	4,580	43	-23	5,410	3,500	31
5–3300	Minnesota River near Jordan, Minn	16,200	3,412	908	95	-24	1,090	704	31
5–3310	Mississippi River at St. Paul, Minn	36,800	[1] 10,580	5,285	84	-27	6,490	4,200	30
5–3655	Chippewa River at Chippewa Falls, Wis	5,600	5,110	6,360	246	-47	14,800	9,570	27
5–4070	Wisconsin River at Muscoda, Wis	10,300	8,613	10,800	197	-52	.....	.....	.....
5–4465	Rock River near Joslin, Ill	9,551	5,852	8,480	352	-20	6,900	4,460	31
5–4745	Mississippi River at Keokuk, Iowa	119,000	62,570	69,090	218	-31	63,800	41,200	31
6–2145	Yellowstone River at Billings, Mont	11,796	6,986	6,030	152	+7	4,700	3,040	31
6–9345	Missouri River at Hermann, Mo	524,200	79,750	46,420	84	-8	48,300	31,200	27
7–2890	Mississippi River at Vicksburg, Miss[4]	1,140,500	573,600	266,200	101	-20	235,000	152,000	27
7–3310	Washita River near Durwood, Okla	7,202	1,414	147	29	+332	95	61	31
8–2765	Rio Grande below Taos Junction Bridge, near Taos, N. Mex	9,730	724	210	74	-4	200	130	31
9–3150	Green River at Green River, Utah	40,600	6,366	1,495	60	+56	2,400	1,550	31
11–4255	Sacramento River at Verona, Calif	21,257	19,150	9,080	103	-33	7,350	4,750	28
13–2690	Snake River at Weiser, Idaho	69,200	18,170	12,910	89	-8	13,900	8,980	26
13–3170	Salmon River at White Bird, Idaho	13,550	11,290	4,526	92	-17	4,430	2,860	26
13–3425	Clearwater River at Spalding, Idaho	9,570	15,570	4,282	112	-47	3,880	2,510	26
14–1057	Columbia River at The Dalles, Oreg[5]	237,000	194,600	79,500	86	-12	.....	.....	.....
14–1910	Willamette River at Salem, Oreg	7,280	23,810	3,150	43	+17	11,300	7,300	27–31
15–5155	Tanana River at Nenana, Alaska	25,600	23,850	17,000	105	-38	13,000	8,400	31
8MF005	Fraser River at Hope, British Columbia	83,800	96,400	73,090	96	-20	51,200	33,100	31

[1] Adjusted.
[2] Records furnished by Corps of Engineers.
[3] Records furnished by Buffalo District, Corps of Engineers, through International St. Lawrence River Board of Control. Discharges shown are considered to be the same as discharge at Ogdensburg, N.Y. when adjusted for storage in Lake St. Lawrence.
[4] Records of daily discharge computed jointly by Corps of Engineers and Geological Survey.
[5] Discharge determined from information furnished by Bureau of Reclamation, Corps of Engineers, and Geological Survey.
*The U.S. station numbers as listed in this table are in a shortened form previously in use, and used here for simplicity of tabular and map presentation. The full, correct number contains 8 digits and no punctuation marks. For example, the correct form for station number 1–3185 is 01318500.

SELECTED STREAM-GAGING STATIONS ON LARGE RIVERS



Location of stream-gaging stations on large rivers listed in table on page 18.

WATER RESOURCES REVIEW

October 1980

Based on reports from the Canadian and U.S. field offices; completed November 17, 1980

TECHNICAL STAFF
Allen Sinnott, Editor
Carroll W. Saboe, Associate Editor
Herman D. Brice
Ruth M. Kosco
Ada Derrenbacker
John C. Kammerer
Penny B. Fink

COPY PREPARATION
Lois C. Fleshmon
Sharon L. Peterson
Daphne L. Chinn

GRAPHICS
Frances B. Davison
Carolyn L. Moss
Leslie J. Robinson
Joan M. Rubin
Diane M. Johnson

EXPLANATION OF DATA

Cover map shows generalized pattern of streamflow for October based on 20 index stream-gaging stations in Canada and 130 index stations in the United States. Alaska and Hawaii inset maps show streamflow only at the index gaging stations which are located near the points shown by the arrows.

Streamflow for October 1980 is compared with flow for October in the 30-year reference period 1941–70. Streamflow is considered to be *below the normal range* if it is within the range of the low flows that have occurred 25 percent of the time (below the lower quartile) during the reference period. Flow for October is considered to be *above the normal range* if it is within the range of the high flows that have occurred 25 percent of the time (above the upper quartile).

Flow higher than the lower quartile but lower than the upper quartile is described as being *within the normal range.* In the Water Resources Review the median is obtained by ranking the 30 flows of the reference period in their order of magnitude; the highest flow is number 1, the lowest flow is number 30, and the average of the 15th and 16th highest flows is the median.

The normal is an average (but not an arithmetic average) or middle value; half of the time you would expect the October flows to be below the median and half of the time to be above the median. Shorter reference periods are used for the Alaska index stations because of the limited records available.

Statements about *ground-water levels* refer to conditions near the end of October. Water level in each key observation well is compared with average level for the end of October determined from the entire past record for that well or from a 20-year reference period, 1951–70. *Changes in ground-water levels,* unless described otherwise, are from the end of September to the end of October.

The Water Resources Review is published monthly. Special-purpose and summary issues are also published. Issues of the Review are free on application to the Water Resources Review, U.S. Geological Survey, Reston, Virginia 22092.

GRINNELL AND SPERRY GLACIERS, GLACIER NATIONAL PARK, MONTANA—— A RECORD OF VANISHING ICE

The abstract and illustrations below are from the report, *Grinnell and Sperry Glaciers, Glacier National Park, Montana—a record of vanishing ice*, by Arthur Johnson: U.S. Geological Survey Professional Paper 1180, 29 pages, 1980. This report may be purchased for $3.25 from Branch of Distribution, U.S. Geological Survey, 1200 S. Eads St., Arlington, Va 22202 (check or money order payable to U.S. Geological Survey); or from Superintendent of Documents, Government Printing Office, Washington, D.C. 20402 (payable to Superintendent of Documents).

ABSTRACT

Grinnell and Sperry Glaciers, in Glacier National Park, Mont. (fig. 1), have both shrunk considerably since their discovery in 1887 and 1895, respectively. This shrinkage, a reflection of climatic conditions, is evident when photographs taken at the time of discovery are compared with later photographs. (See figures 2 and 3.) Annual precipitation and terminus-recession measurements, together with detailed systematic topographic mapping since 1900, clearly record the changes in the character and size of these glaciers.

Grinnell Glacier decreased in area from 530 acres in 1900 to 315 acres in 1960 and to 298 acres in 1966. Between 1937 and 1969 the terminus receded nearly 1,200 feet. Periodic profile measurements indicate that in 1969 the surface over the main part of the glacier was 25–30 feet lower than in 1950. Observations from 1947 to 1969 indicate annual northeastward movement ranging from 32 to 52 feet and generally averaging 35–45 feet. The annual runoff at the glacier is estimated to be 150 inches, of which approximately 6 inches represents reduction in glacier volume. The average annual runoff at a gaging station on Grinnell Creek 1.5 miles downvalley from the glacier for the 20-year period, 1949–69, was 100 inches. The average annual precipitation over the glacier was probably 120–150 inches.

Sperry Glacier occupied 800 acres in 1901; by 1960 it covered only 287 acres, much of its upper part having disappeared from the enclosing cirque. (See table 1.) From 1938 to 1969 certain segments of the terminus receded more than 1,000 feet. Profile measurements dating from 1949 indicate a lowering of the glacier surface below an altitude of 7,500 feet, but a fairly constant or slightly increased elevation of the surface above an altitude of 7,500 feet. Along one segment of the 1969 terminus the ice had been more than 100 feet thick in 1950. According to observations during 1949–69, average annual downslope movement was less than 15 feet per year in the central part of the glacier and slightly more rapid toward the edges and at higher parts on the glacier.

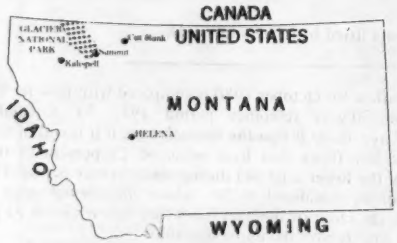


Figure 1.—Map showing location of Glacier National Park, Montana.

Figure 2.—Earliest available general view of Grinnell Glacier and surroundings, taken from trail along south side of Mt. Grinnell, in 1900.

Figure 3.—Grinnell Glacier from same location as in Figure 2, taken in 1935. Note that the glacier has separated into upper and lower parts, and has receded and shrunk considerably during the 35 years since 1900.

Table 1.—*Decrease in acreage of Sperry Glacier since it was first mapped in 1901*

Year	*Source of date*	*Area (acres)*	*Reduction in acreage since previous measurement*	
			Total	*Average per year*
1901	Chief Mountain quadrangle map	800	...	...
1938	Sperry Glacier map (Dyson)	390	410	11.1
1946	...do	330	60	7.5
1950	Sperry Glacier map (USGS)	305	25	6.2
1960	...do	287	18	1.8